Agricultures
et défis du monde
Collection Cirad-AFD

The agroecological transition of agricultural systems in the Global South

F.-X. Côte, E. Poirier-Magona,
S. Perret, P. Roudier,
B. Rapidel, M.-C. Thirion,
éditors

éditions Quæ

Chapter 14

The ecologisation of agriculture through the prism of collaborative innovation

Aurélie Toillier, Prosper Kola, Syndhia Mathé, Sygnola Tsafack, Der Dabire, Bernard Triomphe

Calls for collaborative innovation in the agricultural sector continue to grow (Von Hippel, 2005; Swaans *et al.*, 2014; Temple, 2017; Toillier *et al.*, 2018a) with an increasing awareness of the wide range of actors who interact and contribute to innovation: SMEs, service companies, institutions, public actors and even civil society acting through NGOs.

Collaborative innovation can be defined as the creation of innovations outside the boundaries of organizations and through the sharing of ideas, knowledge, expertise, resources and opportunities (Demil and Lecoq, 2012; Ketchen *et al.*, 2007). It is a way of initiating or setting up joint innovation projects through an emphasis on inter-organizational relationships and on the basis of the ability of a diversity of organizations and individuals to progress together, outside of their usual working environments.

Collaborative innovation seems to be especially relevant when looking for ways to support the ecologisation of agriculture. Indeed, it has long been established that an engagement in the agroecological transition cannot be an individual undertaking, since it requires the sharing of resources, knowledge, experiences and spaces, and involves externalities at scales that exceed those of the farm and the production system (Whiteside, 1998; Uphoff, 2002; Oborn *et al.*, 2017; Meynard, 2017). Furthermore, even though many organizations share a desire to find new ways of leveraging natural mechanisms to produce, of respecting the environment better and of meeting the criteria of sustainability in general, it is usually only through multi-stakeholder local mechanisms that solutions are found (Van Mierlo *et al.*, 2017). In the absence of universally applicable solutions, Weltin *et al.* (2018) note that, in all the regions of the world, practitioners have identified the need to co-develop common solutions and actions to implement ecological intensification strategies appropriate to the regional context and local ecosystems. In each case, it is necessary to mobilize actors with different perspectives, to hybridize different types of knowledge (scientists, experts, practitioners) and to anchor the design and implementation of innovations locally (Warner, 2008).

To initiate and organize these dynamics of collaborative innovation, support mechanisms such as innovation platforms and facilitated networks[1] are increasingly being mobilized (Van Mierlo *et al.*, 2017; Beers and Geerling-Eiff, 2014). However, in developing countries in which innovation systems are still highly compartmentalised and where the resources allocated to the agroecological transition remain limited (see Chapter 10), the implementation of such support mechanisms raises real methodological challenges for practitioners of accompaniment. They have to help individuals reorient their practices towards forms of collaborative work they have no training in, and have to catalyse relationships between multiple organizations which may not always be convinced of the benefits of working together. It is a matter mainly of helping these organizations agree on common objectives and produce results that are useful for innovation even though they are used to favouring their own work and to being competitive in order to obtain funding.

How do the mechanisms currently deployed in the Global South help trigger dynamics of collaborative innovation that can be useful for the agroecological transition? What are the difficulties encountered and how can they be overcome?

This chapter throws lights on these questions. The first part justifies the interest in studying the ecologisation of agriculture through the prism of collaborative innovation and of its paradoxes. The second part describes a diversity of collaborative mechanisms mobilized at different levels at which the agroecological transition is organized. Examples from Burkina Faso and Cameroon illustrate the different organizational forms mobilized and the way in which they help overcome certain paradoxes of collaborative innovation in order to make actors move forward. The conclusion provides a perspective for future research.

Collaborative innovation as a way to stimulate the ecologisation of agriculture

A creative bubble within socio-technical networks

The concept of collaborative innovation extends that of 'open innovation', which is based on an organization's ability to open itself up to others in order to innovate, cooperate, and share technologies and intellectual property rights within a given sector and for profit (Chesbrough, 2006; Gassmann *et al.*, 2006). Through his study of innovation communities and their modes of collaboration, Gläser (2001) shows that economic motivation is not always a determining factor. It is instead a matter of voluntary association of actors, not necessarily having the same organizational affiliation but united by a shared objective of creation, adaptation, adoption and dissemination of an innovation.

1. A facilitated network is a business model based on a shared platform that allows individuals to exchange resources and services. Facilitated networks are a means of optimizing collaboration and learning between organizations, most generally by allowing the platform to monetize its resources and services (membership, access and participation rights).

In the movements to ecologise agriculture, different types of actors play key roles at different times to initiate a path of technological or institutional change in agreement with other actors. Genus and Coles (2008) refer to the realignment of networks in the tradition of actor-network theory. Garud *et al.* (2002) have shown that these agents of change are usually 'distributed, partisan and integrated' into technological and institutional trajectories. On the one hand, they participate in pursuit of their own interests. On the other, solutions emerge through partisan mutual adjustments that require an engagement by actors on the very path they have helped to create. In developing countries, actors engaged in agroecological innovation are still not very diverse and few in number, which further limits the range of possibilities. They originate mainly from the public sphere and civil society, intervening according to a project-centric logic, with projects funded by international cooperation entities or public aid. Most often, their relationships are defined by past history and impart predictability to their interactions, leading more to consensual choices and incremental innovations than true revolutions in agricultural models.

Mechanisms to support collaborative innovation attempt to lift individuals from their usual working environments and project them into another dimension, with different metrics, in particular new metrics of time. Blandin *et al.* (2016) speak of the 'creative bubble' in which we seek to accelerate or even 'precipitate' relational and cognitive processes between individuals. It is a matter of saving time by identifying quickly a multitude of new ideas, drivers of solutions, or inter-organizational arrangements to facilitate the emergence of new solutions or the leveraging of opportunities for change.

Collaborating to solve problems

Ecological intensification requires a greater mobilization of natural mechanisms, i.e. those pertaining to ecology, or even their amplification so that they become almost exclusive (or dominant) in terms of agricultural practices, for the ultimate benefit of food production and other societal needs (Griffon, 2013). At the very least, ecologically intensive agriculture aims to maintain the same agricultural yield as a conventional model but with a reduction in the use of artificial chemical inputs. Ecological intensification has to face multiple challenges at the levels of the farm, the territory and the agrifood system as a whole (Meynard, 2017). We can distinguish between simple, complicated and complex problems, all of which call for different mechanisms of innovation and collaboration (Toillier *et al.*, 2018a). These different types of problems require different orders of change. Waddell (2011) distinguishes between three types of change: incremental change, reform, and transformation (Table 14.1), with the latter being the most difficult to achieve. Moreover, simple and complex problems may be a nested or appear in sequence. For example, the apparently simple problem of access by producers to improved seeds – discussed in the case of the Mbalmayo innovation platform in Cameroon (Mathé *et al.*, 2018) and the plantain banana platform in Côte-d'Ivoire (Angbo-Kouakou *et al.*, 2017) – will, sooner or later, raise complex problems of governance in the seed sector that will require a systemic or transformational change, and will therefore need new forms of collaboration to solve them.

Table 14.1. Types of changes that are involved in collaborative innovation mechanisms (adapted from Waddell, 2011; and from Snowden and Boone, 2007).

Problem	Simple	Complicated	Complex
Type of change	Incremental Improving performances	Reform Changing the ways different parts of a system interact	Transformation Creating hitherto unsuspected possibilities, imagining solutions that do not yet exist
Examples	Developing agri-chains that derive value from products resulting from ecological intensification	Creating new rules for the use of resources at the scale of a village territory	Introducing and promoting certified organic farming in a country
Modalities for resolving problems	Changing the ways of acting and behaving	Changing the ways of thinking	Changing the ways of perceiving one's environment
Key questions	How can we do more of the same thing or do it better?	What rules do we need to create?	How can we impart sense to all this?
Learning loop	Single loop	Double loop	Triple loop
When does it take place?	Predictable timeframe for common problems	When we can formulate the problems but cannot arrive at solutions	When we are unable to formulate the problems and unable to find solutions
Who participates?	The actors who formulate the problems	The actors of the concerned system	The actors who help make the system intelligible in its different dimensions
The individual's relationship with the collective	The collective explains the individuals' roles so that everyone acts on the problem	The individual does not feel responsible and believes that it is others who have created the problem	The collective confronts the problem all together and considers itself to be part of the problem and of the solution
Implications for collaborative mechanisms	Can rely on existing hierarchical structures (such as a value chain) to organize collective action Can use a logical framework	Requires the production of a large amount of knowledge because cause-and-effect relationships are not obvious Rigorous planning, multiple types of expertise, poorly suited logical framework	Conducting a number of experiments, generating a large amount of feedback in order to choose strategies that work, learning is achieved through successive failures Change-oriented planning
Examples of collaborative innovation mechanisms	Multi-service innovation platforms guided by agri-chain actors For example, the Mbalmayo platform in Cameroon (Mathé *et al.*, 2018)	Innovation platforms guided by the research community using Action Research in Partnership (ARP) For example, the Abaco platform in Burkina Faso (Dabire *et al.*, 2017)	Facilitated networks For example, the CNABio network in Burkina Faso (Toillier *et al.*, 2017)
Funding mechanisms	Short-term external funding (project)	Long-term external funding (programme)	Internal funding (self-financing)

The paradoxes to overcome

Organization and innovation seem to be two contradictory but inseparable concepts, since the goal of the first is to reduce uncertainty and of the second to take advantage of it. Collaborative innovation must be able to address a set of paradoxes specific to innovation, grouped into three broad categories (Blandin *et al.*, 2016).

Immediate/long term. Innovation is intended to transform practices in a radical manner. This transformation takes time, especially in contexts of agroecological transitions. Different time horizons, beyond just the lifetime of the collaborative mechanism, are involved and have to be taken into account.

Individual/collective. The paradigm of participation in the world of agricultural development has encouraged the systematic inclusion of all stakeholders in innovation support mechanisms, without, however, specifying the details of their inclusion (Schut *et al.*, 2015, or TAP, 2016). Studies on creativity have shown that an innovation collective is not merely a collection of individuals; it also involves a specific kind of management that is necessary for the collective to truly contribute something in addition to the individualities and the ideas of the individuals. On the one hand, the dynamics of individual learning are inseparable from the nature of the relationship with the collective (Hatchuel, 1999) and, on the other, the very composition of the collective influences the group's capacity for innovation (Janssen *et al.*, 2004).

Divergence/convergence. Many mechanisms tend to be divided into two major phases. Such is the case, for example, of a participatory methodology (Duru *et al.*, 2015) designed to promote territorial agroecological transitions. First, we seek and identify problems perceived by the different actors (divergence), then we integrate and evaluate optimal solutions (convergence). In fact, these activities cannot be separated and have to be undertaken in parallel: it is a continuous development-evaluation cycle that makes it possible to take decisions, enrich a proposal or redefine an idea. The challenge is to manage development and evaluation head-on.

Factors of success

There are three known major factors of success for collaborative innovation: the establishment of coordination mechanisms and of protocols for interaction between the different actors; the construction of a common vision; and the mobilization of the resources needed for action.

Coordination mechanisms reduce uncertainty and curb opportunistic behaviour and are thus essential in innovation networks (Dhanaraj and Parkhe, 2006). Indeed, these organizational forms are especially conducive to the exchange of information and the transmission of know-how, but which risk promoting opportunistic behaviour (Goerzen, 2007). Furthermore, the often tacit nature of knowledge and the low degree of predictability of results lead to high levels of uncertainty. The modalities of coordination must make it possible to foster inter-organizational trust, propose conflict management mechanisms, and offer assurances on the use of the results that will be produced (Gardet, 2009).

The interaction protocol consists of selecting the individuals who will collaborate and of organizing the work sequences. Amin and Roberts (2008) show that once the nature of the problem has been identified and the coordination mechanisms chosen, the effectiveness of a collaborative mechanism depends very much on the nature of the actors involved. In a weak context, i.e. when the individuals present have not previously worked with each other, the concretization of ideas and proposals made during interactions will be more difficult than in a strong context (when the individuals present are used to

working together successfully). However, this difficulty can be overcome by an appropriate selection of individuals in terms of the complementarity of their skills and their motivations in seeing the problem resolved. If the selection is lenient, as is very often the case in participatory workshops carried out as part of development projects (open to all who are able to attend or according to a hierarchical criteria defined elsewhere), then the risk of the mechanism's failure is higher, unless these individuals belong to organizations already engaged in an innovative community and are able to exceed individuality-related limitations. The organization of work sequences then consists of alternating collective and individual phases, by offering space and time for experimentation, collaboration and comparison. These alternating phases form the basis of collective learning.

Time joins strategy and common sense as an important consideration. Consistency between and alignment of ambitions, strategies, organization and working methods over time will allow the paradoxes of time to be overcome. Successful cases of collaborative innovation demonstrate a collective motivation to address common challenges, going beyond individual issues. Weick (2001) speaks of 'sense making', i.e., of being able to identify problems together and to impart them with a common sense. This requires the creation of common exchange spaces to co-construct a shared vision.

For collective action to even begin, specific human, material and financial resources must be mobilized. The selection of individuals and organizations in particular plays a key role: different skills are necessary, those of content experts (capable of helping develop the product-innovation) as well as those of process experts (capable of helping organize socio-cognitive processes for the design of the innovation). Indeed, the orchestration of collective action calls for facilitators who can coordinate the interactions between the actors, facilitate discussions, promote communications and the dissemination of information, and play the role of translator or 'boundary bridger'. This role is crucial to the proper functioning of an innovation platform and requires specific skills that these facilitators must bring to the table from the very beginning of the process (Klerkx and Leuwis, 2008; Steyaert *et al.*, 2017).

Figure 14.1 summarizes the combination of factors to be taken into account in understanding the scope, processes and benefits of collaborative innovation mechanisms.

Mismatches between promises and results

On the basis of these factors of success of collaborative innovation mechanisms, we explore how the mechanisms currently deployed in the Global South enable and stimulate the dynamics of collaborative innovation useful for agroecological transitions.

Selection of case studies

To distinguish between existing collaborative mechanisms that are supporting agroecological transitions in the Global South, we have adopted two criteria pertaining to the capacities of the individuals and organizations involved (see Figure 14.1): level of constitution of the innovation community that is mobilized in the collaborative mechanism (strong or weak context), and the level of the individuals participating in the mechanism (strict or lenient selection in terms of individual skills, knowledge and abilities) (Figure 14.2).

From a set of case studies to which CIRAD has contributed in the past, four were selected (Figure 14.2 and Table 14.2) to illustrate a variety of initial configurations of mechanisms according to the chosen criteria, i.e. the capacities of the actors involved (context and selection). This exploratory qualitative study aims to highlight the processes through which collaborative mechanisms deliver on their promises. The analyses presented here are based on published literature that describes the scope and the processes of implementation of each of the four mechanisms and the results obtained.

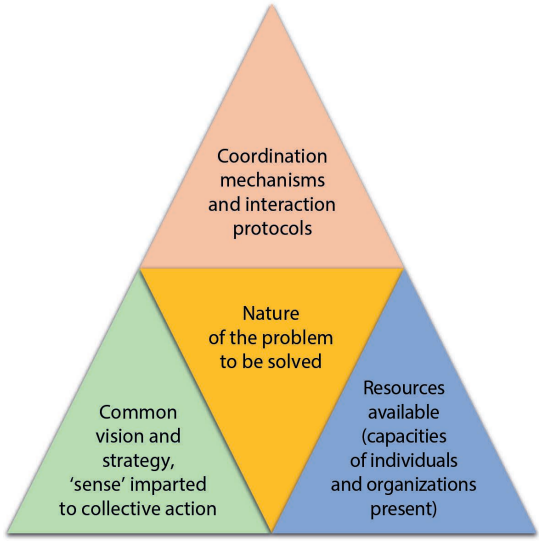

Figure 14.1. Factors of success of collaborative innovation.

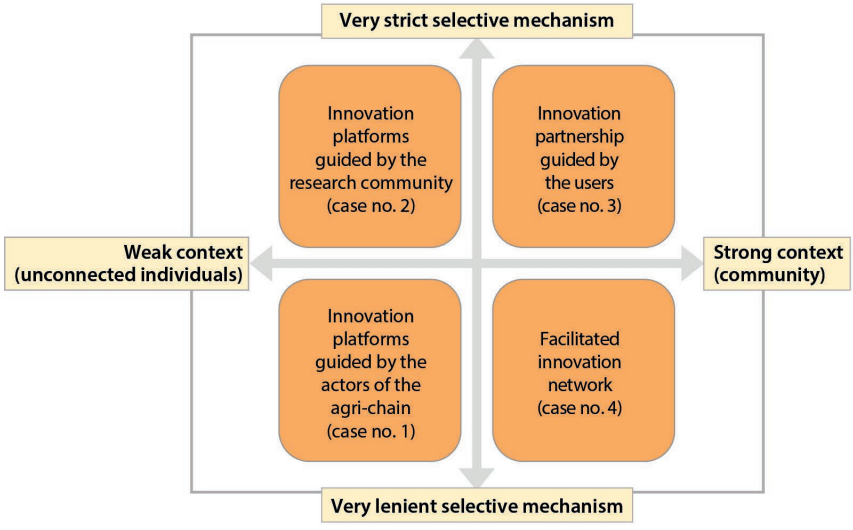

Figure 14.2. Examples of collaborative innovation mechanism according to the capacities of the actors involved: level of inter-organizational relationships and level of selection of participating individuals.

Table 14.2. Examples of collaborative mechanisms for ecological intensification supported by CIRAD in Cameroon and Burkina Faso.

	Aim of the innovation	Examples of collaborative innovation mechanisms	The mechanisms' objectives ('promises')	Actors involved
	Designing and developing new production systems			
Case no. 1	Supporting forms of sustainable intensification using the value chain approach	Multiservice innovation platform guided by the agri-chain's actors: Mbalmayo platform, Cameroon (Mathé *et al.*, 2018)	Identifying local but generalizable technical solutions to optimize crop diversification and enhance soil fertility	Farmers Traders Researchers Agricultural advisers
Case no. 2	Developing conservation agriculture at the village scale	Action research in partnership mechanisms guided by the research community: village platforms of the Abaco project, Burkina Faso (Dabire *et al.*, 2017)	Building technical references adapted to local conditions Changing the rules of governance of common resources (crop residues) at the village level to derive better value from them	Farmers Researchers Traditional village authorities Administrative authorities Agricultural advisers Development NGOs Traders Inputs suppliers Banks Craftsmen, processors
	Designing and developing new services to support transformations on family farms			
Case no. 3	Modifying the approaches used by the producer organization to support its members in order to facilitate ecological intensification	Innovation partnership guided by UGCPA users, Burkina Faso (Toillier and Girard, 2016)	Designing an original communication approach for UGCPA's agri-environmental policy	Producer organization (UGCPA) Researcher (CIRAD) Communications agency (Jade Productions) Facilitating NGO (FARM)
	Developing innovations combining the agriculture and food sectors			
Case no. 4	Introducing and developing organic farming	CNABio facilitated network, Burkina Faso (Toillier *et al.*, 2017)	Developing the first organic farming standard in Burkina Faso Creating the first organic label in Burkina Faso Creating a network of organic farms Developing and organizing support services for organic farms Developing organic agri-chains	Farmers Traders Support and advisory entities (NGO, agricultural adviser) Organic inputs companies Researchers Policymakers

CNABio: National council for organic agriculture (French: *Conseil national de l'agriculture biologique*); UGCPA-BM: Union of Agricultural Product Marketing Groups of Boucle du Mouhoun (French: *Union des groupements pour la commercialisation des produits agricoles de la Boucle du Mouhoun*).

Lessons learnt from these four mechanisms

We illustrate how collaborative innovation was organized in the four selected examples, and examine the functional reasons for the inability of the results to match the promises made. The summary of the analysed cases is presented in Table 14.3.

A lenient selective mechanism in a weak context

As part of a research programme on sustainable agricultural intensification called *Humidtropics*, three innovation platforms were set up at a local level, including the Mbalmayo platform in Cameroon's Central Region (Mathé *et al.*, 2018). The aim was to optimize crop diversification in this region and facilitate sustainable intensification by implementing an agroforestry system. Farmers had to be trained in techniques to propagate local trees, to produce maize and vegetable seeds, and to set up nurseries and experimental plots. They also had to be assisted in implementing more integrated production systems.

All of the local platforms were linked to a national platform that played a coordinating role. Its purpose was also to identify 'meta-problems' – problems that occur at a national rather than only at a local scale –, find generalizable solutions to them and serve as a link to political authorities. The role of the local platforms was to adapt the national framework to their respective contexts. The articulation between these two levels was meant not only to meet the farmers' clearly specified needs in an optimal manner but also to integrate these actions into more global dynamics of the scaling up of adaptable solutions for sustainable intensification.

The results observed after three years of functioning were mixed. For example, the technical responses proposed were ultimately found to be unsuitable because the problem was poorly formulated right at the beginning. The main direct causes behind these identified failures were inadequately used coordination mechanisms, an insufficiently developed common vision, and lack of the appropriate skills of the actors involved. More indirect causes pertained to an intervention that was too limited in time given the scale of the changes that were expected at the individual and organizational levels.

However, Mathé *et al.* (2018) do note that the capacities of the actors involved can be built up:
– by fostering trust with the creation of a space for exchanges between actors who were not used to talking to each other (producers and processors);
– through a better understanding by researchers of the complexity of the needs expressed;
– through the awareness that an improved variety, introduced by the research community, is not necessarily a priority for farmers, since they have other assessment criteria and thus select other, non-recommended, varieties;
– through better coordination between organizations that provide services to producers, such as agricultural advice or access to financial resources, by means of a shared vision of their respective roles.

This case illustrates how a mechanism in a weak context, with an inexact or lenient selection of participants, leads to unsatisfactory results if there is not enough time to deploy the entire protocol of interactions between these actors and if the facilitation is

not properly conducted. In this case, the facilitators were unable to get the researchers and farmers to communicate sufficiently so that they could agree on the varieties to choose and on implementing experimental protocols that could be of interest to both parties. The roles of the participants (farmers, advisory service providers, researchers, funding institutions, inputs suppliers, processors, transporters) within the innovation was also not clearly defined or managed, which led to ineffectual individual actions or even conflicting ones. Facilitators should have received more initial training so that they could, at the very least, have been able to analyse situations in the interaction processes in order to use the right facilitation methods at the right time.

A strict selective mechanism in a weak context

As part of the Abaco (Agroecology-Based Aggradation COnservation agriculture) research and development project coordinated by CIRAD, a team of researchers consisting of agronomists, zootechnicians, sociologists and geographers set up and facilitated innovation platforms at the village level between 2011 and 2014 in Burkina Faso. The objective was to co-build, with all the farmers and governance actors in these territories, farming systems based on the principles of conservation agriculture (Dabire *et al.*, 2017).

This objective, initially driven by the research team, was in line with local demand for solutions to reduce soil depletion and to increase productivity, as well as to better leverage crop residues as a source of biomass during the dry season. This collective construction of shared objectives went on for almost a year, with the search at the same time for a mode of operation of the innovation platform that would be anchored in local dynamics specific to each village. Each platform was thus built on a selection of actors to mobilize, based on prior analyses of existing organizations and their roles in managing agricultural resources. The protocol of interactions between researchers and actors was jointly decided upon and led to the validation of an operational framework for experimentation and validation of the results obtained. It brought together a technical body dealing only with the experimental aspects of the project and an institutional body in charge of overseeing relationships between the participants for the proper conduct of the experiments.

At the end of three years of functioning, the results were seen to be positive in terms of the changes in farmers' perceptions, attitudes and practices concerning the implementation of conservation agriculture. Collaborative work allowed all participating individuals to find new solutions at the scale of the village territory to problems encountered at the farm level. The innovation platforms were instrumental in the initiation of the social process necessary for a transition to new farming systems based on principles of conservation agriculture. However, the operational implementation of the collectively identified and validated solutions remains a problem in its own right. It will require new methods since the actors concerned did not make any commitments to undertake changes over the medium and long term. There can thus be no guarantee that the solutions will actually be implemented. Moreover, the platform was not designed to function beyond the design of solutions and did not have funding for continuing operations beyond the duration of the Abaco project.

This case illustrates how double-loop learning has been achieved, essentially allowing people to change their ways of thinking and find new solutions to complicated problems – but without going so far as to actually implement these solutions. The authors highlight two main factors of success:
– the mobilization of existing inclusive organizations, already involved in activities in line with those of the innovation platform, which helped the endeavour gain legitimacy rapidly and convince the farmer audience, in order to promote dialogue around the design of new agricultural systems based on the principles of conservation agriculture;
– the careful establishment of coordination mechanisms and interaction protocols for the various actors to ensure consistency between the exploration of technical issues and of institutional issues in the changes being tried out.

A strict selective mechanism in a strong context

In western Burkina Faso, the Union of Agricultural Product Marketing Groups of Boucle du Mouhoun (UGCPA-BM, in French: *Union des groupements pour la commercialisation des produits agricoles de la Boucle du Mouhoun*) adopted an agri-environmental policy to implement its vision of change in farming practices aimed at ensuring the sustainability of its members' production systems in the medium and long term. This policy encourages the adoption of ecological techniques for soil fertilization (green manure, mulching, improved fallows, legumes), erosion control (stone barriers, agroforestry), reduction in the use of chemical inputs, and the promotion of organic farming. In order to encourage the acceptance of its vision by its members and thus facilitate the adoption of agroecological techniques, UGCPA-BM roped in one of its close partners, the Foundation for World Agriculture and Rurality (French acronym: FARM), to help it design an original communications approach for its agri-environmental policy through the use of innovative technologies. Thus, in 2013, FARM launched an innovation partnership for a two-year period that brought together the producer organization (UGCPA), the research community (CIRAD) and a communications agency (Jade Productions) with which previous collaborations had been successful. The objective of these partners was to design this approach together, with the partners being selected for their complementary skills and viewpoints on the issues of communication and ecological intensification.

The design of the communications approach spanned several months. It was a reflexive, iterative and participatory process and alternated phases of collective work, field data collection and restitution, and internal reflection at UGCPA. The process was guided by the need for the organization to formulate its requirements and expectations from the agri-environmental policy it wished to implement. Each stage was designed to incorporate new elements to help develop the communications approach. The result was an unprecedented approach to support producers which combined participatory video and collective advisory sessions.

While the UGCPA was very satisfied with the result, the fact remains that the innovation produced (the communications approach using the participatory video) was not very original, even if was a novelty for the producer organization. We can therefore question the need to take recourse to such a relatively expensive collaborative

mechanism. But there was another result, especially significant with regard to the ecological transition. It concerned the building up of the capacities of the producer organization: capacities to formulate a vision and to organize change; to organize itself to carry out identified actions effectively; to be able to communicate internally, with its members and with its partners; and to adopt a reflexive, step-by-step approach to evaluate its actions. Toillier and Girard (2016) show that it was the protocol consisting of very sequenced interactions between the four partners that allowed this capacity building. Collective designing phases were alternated with internal phases of 'individual' work within organizations, each in its area of expertise: an experimentation phase, adjustment phases between two or three partners, and collective pooling phases. This protocol fostered the partners' commitment and the recognition of the potential of individual initiatives through shared trust, and enabled individual and organizational learning. The collaborative innovation mechanism in itself became a capacity building mechanism for the producer organization. The real internal transformation that resulted represents an asset for accelerating the agroecological transition: UGCPA is now better placed to express its needs to its partners and target its support to its members more effectively.

A lenient selective mechanism in a strong context

The National Council of Organic Agriculture (CNABio, in French: *Conseil national de l'agriculture biologique*) is an association created in 2011 to bring together actors and initiatives to support organic agriculture in Burkina Faso. Its members consist of about 40 organizations: groups of producers, traders, private suppliers of inputs, NGOs and consumers. The strict selection of members is based on their agreement on a vision, a commitment to develop agroecology and organic farming, specific technical skills, and the pooling of resources.

As the umbrella organization of a national network, CNABio's mission is to provide an organized framework to collectively remove the obstacles to the emergence of organic agriculture and agroecology. Thus, a new Burkinabe standard was introduced in 2013, followed by the first certification label in 2016. More than a dozen farms have since been certified, which is contributing to the development of agri-chains and new markets. However, many challenges remain: most notably, promoting access to organic inputs and imparting long-term durability to organic production systems, in particular by using certain agroecological techniques. In order to strengthen its capacity to support these technical and organizational innovations, CNABio has received support from CIRAD in the form of a project, launched in 2016, dedicated to building capacity to innovate. This project has equipped CNABio with the technical, methodological and financial resources required to carry out collective actions of experimentation, consultation and coordination with its network's members. CNABio has found participatory methods of identifying the needs of these members and facilitation skills to be the most useful. By consolidating its interaction framework and coordinating mechanisms, CNABio has, for example, quickly been able to identify new strategies for improving linkages between the production and marketing of organic products. A one-off project was then set up with new partners to implement new short-circuit marketing solutions in a targeted manner.

This case study shows how a facilitated network self-funded over the medium term is in itself a collaborative innovation mechanism. In response to a complex problem, the gradual building of a common vision, the presence of a legitimate federating organization able to mobilize other organizations, the confidence gained as a result of the various collective successes, the regularity of structured exchanges over the long term, and the commitment engendered through the membership of this network appear as factors of success in the deployment of changes at multiple levels (Toillier *et al.*, 2017). These invisible results are forming the basis for setting up well-defined technical projects, to which donors are responding increasingly positively. The network has thus begun to reverse the traditional donor-recipient dynamics by convincing donors to align with its needs and not to respond, on a case by case basis, to its requests for funding. Thus the existence of a common strategy and coordination mechanisms compensate for initially low levels of resources (human, financial, material) by building up the network's capacity to become involved in long-term strategic and political processes. The consequence of these multi-level learning processes (individuals, organizations, inter-organizations) is that the time steps of any action are long (exceeding ten years).

Summary and discussion

Our observations from the four case studies lead us to discuss three ideas: the calling into question of the project-centric approach; the need for a support team instead of facilitators to manage the paradoxes of innovation projects; and the role of collaborative innovation mechanisms in agroecological transitions.

Can innovation be managed through projects?

In all the four cases, the technical results can be considered limited, either not very original or providing answers only partially to the problem posed in terms of the technical issues formulated initially. The bulk of the changes and outcomes concern the improvement in individual skills and collective capacities to formulate problems for progressing together. However, these non-technical functional and cognitive changes are seldom goals in their own right at the time the collaboration mechanism is launched. This leads to results falling short of the promises of change made at the outset.

In three of the four cases, the mechanism is limited to helping the actors develop an idea, and design solutions in an experimental manner until they arrive at a prototype that meets a set of technical and functional criteria, i.e. an acceptable and desired solution that responds satisfactorily to the stated problems or needs. However, this is only a first part of its implementation: in case no. 4, the participatory videos had yet to disseminated and collective advisory sessions had yet to be organized; in case no. 2, the techniques of conservation agriculture had yet to be widely applied and land charters integrating the management of crop residues had yet to be implemented; and in case no. 3, the producers had yet to be supplied with adapted seeds. These unfulfilled goals raise new and complex challenges. Either the participants are sufficiently independent and motivated to act on their own afterwards – as was the

case of the UGCPA, which has since implemented its communications approach, or CNABio, which is putting together projects to find the funding necessary for implementing its strategy of rolling out organic farming – or they are not, and the dynamics of innovation fizzle out. The mechanism has thus mainly contributed to the emergence of an innovation community that has to wait for a new project to continue the work, as is often the case in countries of the Global South where actors are used to 'project-centric logic'. Triomphe *et al.* (2016) confirm this observation by tracing innovation trajectories *ex post*. These trajectories are found to be structured mainly by clusters of projects most often focused on technological development issues. They span several decades and it is only at the end of this period that the innovation arrives at a successful conclusion.

Our observations show, however, that it is process-centric logic that really triggers collective dynamics of problem solving and the application of novel solutions adapted to specific needs; development projects are only used in a second phase to obtain the financial means necessary for experimentation or dissemination of new technologies (case no. 3). Lucas *et al.* (2016) confirm, in the French context, that it is the farmers' quest for autonomy and self-sufficiency that enables them to produce agroecological innovations. The problem of implementing solutions does not exist because the process of collaborative innovation is maintained over time, irrespective of funding or external interventions. In case study no. 3, by its very mandate, the lead organization (CNABio) constantly mobilizes resources to ensure the continued implementation of the solutions identified collectively, and to repeat iterations of collaboration, comparison and experimentation phases as often as necessary. This process can take place only over a long period (exceeding ten years) and with a pivotal organization that takes charge of the coordination mechanisms, the interaction protocols and the setting up of projects adapted to the identified needs and which are in line with the action timeframe of the actors involved in the innovation process (Toillier *et al.*, 2017). Lenfle (2004) shows how the management of innovative projects differs from that of development projects, in terms mainly of the nature and skills of the actors to be involved, the temporalities to be considered and the management principles to be used. Thus it is not the project-centric approach in itself that has to be called into question; it is the purpose of the project as well as the management principles and methods that need examination.

In this perspective, collaborative innovation mechanisms should be thought of more as structures able to lead and undertake a long-term innovation process and to manage a portfolio of projects that will strategically address specific problems step by step. In this sense, facilitated networks are more appropriate and effective forms of organization to lead an innovation project than the innovation platforms cobbled together during a short-term development project. The case of CNABio's facilitated network (case no. 4) shows how 'process-centric logic' promoted by collaborative innovation can displace the project approach in order to allow time for an innovation to deploy in all its social, technical, and institutional dimensions. The truly useful projects that bring about effective change then emerge later, at the appropriate times, when the actors have a common purpose and vision, have identified a solution to implement, and have divided up roles and responsibilities.

From the facilitator to the support team

In all four cases, the factors of success of the collaborative innovation mechanism could not be fully materialized, a shortcoming that led to results falling short of the initial intentions and the objectives assigned to the mechanisms. Table 14.3 presents the strengths and weaknesses of the four collaborative mechanisms studied. The two cases with the most comprehensive coordination mechanisms and interaction protocols were the ones whose results came closest to the initial objectives (the Abaco platform and the innovation partnership between UGCPA, FARM, CIRAD and Jade Productions). In one case, this co-ordination and organization role was played by the research community (CIRAD), and in the other by a facilitating NGO (FARM), two organizations which already had extensive experience with this type of approach. In the other two cases, this role was played by *ad hoc* facilitators whose capacities to do so were limited, especially because they lacked an overall vision of the processes at work in the interactions between the different organizations. Many studies (Klerkx and Leeuwis, 2008, 2009) have already stressed the importance and complexity of facilitating collective innovation processes but they pertain relatively rarely to the nature of the particular problem to be solved. Steyaert *et al.* (2017) show that, in agroecological transitions, the problems posed involve contradictions with very high social expectations that make them especially challenging to resolve and carrying out the planned actions becomes difficult. As a result, the facilitator's ability to create an organized but flexible framework for effective collective action is key.

To be able to discuss the need to guide and manage collaborative mechanisms, we designate as 'support capacities' the capabilities required to make these mechanisms function. These support capacities span several different types and can rarely be found in a single individual. In addition to the aspects already identified in the literature, we note that it is also a matter of understanding the technical and organizational challenges of innovation to a certain extent; of knowing the network of actors involved and understanding the interplay between them; of being able to propose experimentation strategies adapted to different situations as well as more or less formalized forms of arrangement that will be acceptable to the actors involved (partnerships, contracts, commitment charters, etc.); and of being familiar with protocols of interaction between different types of organization, with specific monitoring-evaluation tools, and with techniques of reflexive analysis. The challenge is to deploy an approach to support actors in a situation of innovation so that their technical or organizational needs can be satisfied as and when required.

While the figure of the facilitator is considered important by authors across the literature, the empirical results of our case studies show that what is more effective are facilitation teams or, more generally, support teams formed on an *ad hoc* basis that cover all the required skills. These teams consist of researchers, development agents from participating organizations, individuals designated as 'facilitators' for the duration of the project, and farmer leaders who represent the interests of the innovation's beneficiaries. These teams are formed as and when problems of collaboration emerge and end up taking charge of the functioning itself of the collaborative mechanism. More attention therefore must be paid to the constitution of these teams, to the methodological

tools made available to them, and to the building up of their technical and functional capacities, all of which will condition the innovation's speed of progress and effectiveness. Toillier *et al.* (2018b) show in particular the diversity of possible postures that researchers can adopt and the capacities required to accompany an innovation process. They can play the role of trainers, experts, communicators, or catalysts who bring together different categories of actors. Their adaptability is essential in order for them to play a supporting role since, by its very nature, innovation is unpredictable.

There exist few projects or training programmes dedicated to creating or building up these skills. Two avenues are foreseeable: capacity building undertaken internally by those organizations that want to be able to lead or manage collaborative innovation mechanisms; and an *ad hoc* capacity building through a project at the time a collaborative mechanism is implemented.

Table 14.3. Summary of analyses of cases.

	Case no. 1	**Case no. 2**	**Case no. 3**	**Case no. 4**
Case study	Multi-service innovation platform Cameroon	Abaco innovation platform guided by the research community, Burkina Faso	Innovation partnership between UGCPA, FARM, CIRAD, Jade Productions Burkina Faso	CNABio facilitated network Burkina Faso
Aim of the collaboration	To initiate collective problem-solving dynamics in an agri-chain	To initiate collective problem-solving dynamics in a village	To solve a one-off problem	To support a complex change over the long term
Main results	Groundwork laid for another, more targeted collective action and for achieving the expected results	Targeted results achieved but they only partially respond to the issues concerned Collective dynamics initiated so that changes that have been started can be continued	The expected product has been finalized but it responds only partially to the issues concerned Capabilities created to continue the changes that have been started	Succession of micro-results that contribute to the overall goal
Coordination mechanisms	– Weak Not formalized	++ Coordination managed by an institutionalized body at the village level	++ Coordination managed by collaboration contracts between partners	+ Coordination managed through a system of membership
Interaction protocol	– Not suited to requirements and too short (3 years)	+ Sequenced and relatively short (4 years)	++ Very sequenced and very short (less than 2 years)	– Not formalized and spanning a long period (exceeding 10 years)
Common vision	– Poorly developed	++ Developed	– Partly consensual	++ Developed
Mobilization of the necessary resources	– Inadequate due to the lack of a strategy	+ Partial	++ Sufficient for the stated goals	– Inadequate due to a lack of financial means

Collaborative mechanisms: spaces for support during periods of transition

Through the capacity building of actors of innovation, the four mechanisms studied offer a space or framework to support changes at the individual and organizational levels that are necessary for an agroecological transition. They intervene at different times, at different organizational levels and at different intensities, none of which we have evaluated. We have simply apprehended them through the magnitude of the changes observed as a result of the collaborative activities carried out.

The selected case studies show that these mechanisms can deal with problems at the farm or the village scales to set up new production systems, either at the level of farmer support organizations in order to provide them with more adapted services, or at the level of the agrifood system as a whole. The goal can be to develop a set of novel solutions to a succession of more or less complex problems, or simply to provide a solution to a well-defined problem. This goal depends on the proponents of the mechanism, the resources allocated and the allotted time frame – short term (project), medium term (programme), or long term (facilitated network).

However, these collaborative mechanisms are often perceived to be time-consuming, expensive and with results not commensurate to the promises made. The ecologisation of agriculture, more than any other form of change of production systems, creates problems of very different types that call into question the ways the actors involved in finding solutions to these problems act and behave, the ways they think and the ways they perceive their environment. Collaborative innovation mechanisms are designed to support these individual and organizational transformations while ensuring the continuous production of a set of technical results that help identify novel solutions to the problems raised. Because of the need to make individuals and organizations collaborate outside of their usual framework, these mechanisms must provide sufficiently robust and long-duration coordination arrangements and interaction protocols so that a common vision can be built and resources necessary for action can be mobilized. Our analysis of four case studies shows how shortcomings in these elements stand in the way of the development of satisfactory solutions. The mechanisms thus initiate dynamics that they do not see to their conclusion, and have to therefore exist beyond project-centric approaches to achieve the desired objectives. One solution would be to rely on established organizations already present on the ground if they are able and permitted by their mandates to take charge of managing these mechanisms over the long term.

Conclusion

The aim of this chapter is to examine the scope, processes and advantages of collaborative innovation mechanisms that appear to be necessary for designing and implementing novel solutions and for accelerating agroecological transitions. The very nature and principles of agroecology preclude the existence of transferable technical packages or turnkey technological solutions. The mobilization of the knowledge of the diverse actors involved and experimentation are necessary to arrive at new and viable production systems and services. Collaborative mechanisms thus provide a framework

for exploration, experimentation and scaling up by arranging and organizing interactions between different organizations that do not usually work together.

Using empirical analyses, we have shown the importance of the initial configurations of these mechanisms and of associated interaction mechanisms, which have to be more structured and sequenced the more the initial collaborative context is weak. We have also shown that collaborative innovation has to be based on processes rather than on projects. The discrepancies between the promises made and the results achieved stem from the mismatch between the project-centric approach and the pace of individual and collective learning. It is only because a common vision and strategy is deployed that the actors who undertake an innovation can set up development projects that will meet their needs at the right time. These observations call for a change in the ways of thinking and supporting innovation, one that focuses more on building the capacity of the individuals in charge of the innovation than on the technical results to be achieved. New and more flexible forms of providing support and funding, focused on collaborative processes, need to be discovered to make these mechanisms effective and to thus save time during the different phases of an agroecological transition. They open up new fields of research around issues of managing innovation projects and organizational learning, which are as yet little studied in the agricultural domain in developing countries.

References

Amin A., Roberts J., 2008. Knowing in action: Beyond communities of practice. Research Policy, 37 (2), 353-369.

Angbo-Kouakou E., Temple L., Mathé S., Assemien A., 2017. Plateformes d'innovation comme dispositif d'orientation des trajectoires technologiques des filières agricoles : Cas de la filière banane plantain en Côte-d'Ivoire. Technologie et innovation, 17 (2), 18 p.

Beers P.J., Geerling-Eiff F., 2014. Networks as policy instruments for innovation. Journal of Agricultural Education and Extension, 20 (4), 363-379.

Blandin C., Frugier D., Gaujard C., Gisselbrecht A., Michel D.A., Poste P., Deroo M.N., 2016. Surmonter les paradoxes de l'innovation collective. Entreprendre & Innover, 3 (30), 61-71.

Chesbrough H.W., 2006. Open innovation: A new paradigm for understanding industrial innovation. In: Open Innovation: Researching a New Paradigm (H.W. Chesbrough, W. Vanhaverbeke, J. West, eds), Oxford University Press, 1-12, Oxford, United Kingdom.

Dabire D., Andrieu N., Djamen P., Coulibaly K., Posthumus H., Diallo A., Karambiri M., Douzet J.-M., Triomphe B., 2017. Operationalizing an innovation platform approach for community-based participatory research on conservation agriculture in Burkina Faso. Experimental Agriculture, 53 (3), 460-479.

Demil B., Lecocq X., 2012. Innovation collaborative et propriété intellectuelle : Quelques bonnes pratiques, Annexe, INPI.

Dhanaraj C., Parkhe A., 2006. Orchestrating innovation networks. Academy of Management Review, 31 (3), 659-662.

Duru M., Thérond O., Fares M., 2015. Designing agroecological transitions. Agronomy for Sustainable Development, 35 (4), 1237-1257, https://doi.org/10.1007/s13593-015-0318-x.

Gardet E., 2009. Modes de coordination instaurés par le pivot d'un réseau d'innovation : Le cas d'un porteur de projet TPE. Management & Avenir, 2009/6 (26), 33-51, https://doi.org/10.3917/mav.026.0033.

Garud R., Jain S., Kumaraswamy A., 2002. Institutional entrepreneurship in the sponsorship of common technological standards: The case of Sun Microsystems and Java. Academy of Management Journal, 45, 196-214.

Gassmann O., Enkel E., Chesbrough H., 2006. The future of open innovation. R&D Management, 40, 3, 2010.

Genus A., Coles A.-M., 2008. Rethinking the multi-level perspective of technological transitions. Research Policy, 37, 1436-1445.

Gläser J., 2001. "Producing communities" as a theoretical challenge. In: Proceedings of The Australian Sociological Association (TASA 2001), 1-11.

Goerzen A., 2007. Alliance networks and firm performance: The impact of repeated partnerships. Strategic Management Journal, 28 (5), 487-509.

Griffon M., 2013. Qu'est-ce que l'agriculture écologiquement intensive ? Quæ, Versailles, 224 p.

Hatchuel A., 1999. Connaissances, modèles d'interaction et rationalisations : De la théorie de l'entreprise à l'économie de la connaissance. Revue d'économie industrielle, 88, 187-209.

Janssen O., Van de Vliert E., West M., 2004. The bright and dark sides of individual and group innovation: A special issue introduction. Journal of Organizational Behavior, 25, 129-145.

Ketchen D.J., Duane I., Snow Ch., 2007. Strategic entrepreneurship, collaborative innovation, and wealth creation. Strategic Entrepreneurship Journal, 1 (3-4), 371-385.

Klerkx L., Leeuwis C., 2008. Balancing multiple interests: Embedding innovation intermediation in the agricultural knowledge infrastructure. Technovation, 28, 364-378.

Klerkx L., Leeuwis C., 2009. Establishment and embedding of innovation brokers at different innovation system levels: Insights from the Dutch agricultural sector. Technological Forecasting & Social Change, 76, 849-860.

Lenfle S., 2004. Peut-on gérer l'innovation par projet ? In: Faire de la recherche en management de projet (G. Garel, V. Giard, C. Midler, eds), Vuibert, Paris, 11-34.

Lucas V., Gasselin P., Van der Ploeg J.D., 2016. Increasing searches for autonomy among French farmers: A starting point for agroecology? In: 12th European IFSA Symposium (IFSA, ed.), Harper Adams University, United Kingdom, 12-15 July 2016, 12 p.

Mathé S., Tsafack S., Degrande A., Fotso A., Nkafu A., Idrissou L., Bisseleua H., Bidogeza J.-C., Suh C., 2018. Les plateformes d'innovation comme nouveaux dispositifs multi-services pour le renforcement des capacités à innover des agriculteurs au Cameroun. In: Les Nouveaux Modes d'organisation des processus d'innovation, congrès RRI - Forum innovation VIII, 4 and 5 June 2018, Nîmes, 24 p.

Meynard J.M., 2017. L'agro-écologie, un nouveau rapport aux savoirs et à l'innovation. OCL, 24 (3), D303.

Oborn I., Vanlauwe B., Phillips M., Thomas R., Brooijmans W., Atta-Krah K., eds, 2017. Sustainable Intensification in Smallholder Agriculture: An integrated systems research approach, Earthscan Publications, London/New York, United Kingdom/United States, 387 p.

Schut M., Klerkx L., Rodenburg J., Kayeke J., Hinnou L.C., Raboanarielina C.M., Bastiaans L., 2015. RAAIS: Rapid Appraisal of Agricultural Innovation Systems (Part I). A diagnostic tool for integrated analysis of complex problems and innovation capacity. Agricultural Systems, 132, 1-11.

Snowden D., Boone M., 2007. A leader's framework for decision making. Harvard Business Review, November issue.

Steyaert P., Barbier M., Cerf M., Levain A., Loconto A., 2017. Role of intermediation in the management of complex sociotechnical transitions. In: Agroecological Transitions: Changes and breakthroughs in the making (B. Elzen, A. Augustyn, M. Barbier, B. Van Mierlo, eds), Wageningen University & Research, The Netherlands, 257-280.

Swaans K., Boogaard B., Bendapudi R., Taye H., Hendrickx S., Klerkx L., 2014. Operationalizing inclusive innovation: Lessons from innovation platforms in livestock value chains in India and Mozambique. Innovation and Development, 4, 239-257.

TAP (Tropical Agriculture Platform), 2016. Common Framework on Capacity Development for Agricultural Innovation Systems: Conceptual background, CAB International, Wallingford, United Kingdom.

Temple L., 2017. Processus d'innovation dans les transitions agro-écologiques des pays en développement. Technologie et innovation, 17 (2), 4 p.

Toillier A., Compaore E., Kola P., 2017. Can we strategically manage multistakeholder innovation processes in agriculture? Insights from case studies in Burkina Faso. In: Transformative Learning: New directions in agricultural extension and education (Koutsouris et al. eds), 23rd European Seminar on Extension and Education (ESEE), 4-7 July 2017, Chania, Greece.

Toillier A., Girard P., 2016. Comment les organisations de producteurs peuvent-elles accompagner leurs membres vers l'intensification écologique ? Se doter d'une politique agro-environnementale et communiquer : le choix de l'UGCPA/BM au Burkina-Faso. Paris : FARM, 75 p. (Champs d'acteurs, 4), http://www.fondation-farm.org/zoe/doc/farm_cha4_201602_ugcpabm.pdf (retrieved 8 January 2019).

Toillier A., Faure G., Chia E., 2018a. Designing and organizing support for collective innovation in agriculture. In: Innovation and development in agricultural and food systems (Faure et al., eds), forthcoming.

Toillier A., Devaux-Spartakis A., Faure G., Barret D., Marquié C., 2018b. Comprendre la contribution de la recherche à l'innovation collective par l'exploration de mécanismes de renforcement de capacité. Cahiers agricultures, 27, 15002.

Triomphe B., Floquet A., Letty B., Kamau G., Almekinders C., Waters-Bayer A., 2016. Mieux évaluer et accompagner l'innovation agricole en Afrique : Leçons d'une analyse transversale de 13 cas d'études. Cahiers agricultures, 25 (6), e64003, 11 p.

Uphoff N., ed., 2002. Agroecological Innovations: Increasing food production with participatory development, Earthscan Publications, London, 306 p.

Van Mierlo B.C., Augustyn A.M., Elzen B., Barbier M., 2017. Agroecological Transitions: Changes and breakthroughs in the making. In: Agroecological Transitions: Changes and breakthroughs in the making (B. Elzen, A. Augustyn, M. Barbier, B. van Mierlo, eds), Wageningen University & Research, The Netherlands, 9-16.

Von Hippel E., 2005. Democratizing Innovation, MIT Press, Cambridge, Mass., 216 p.

Waddell S., 2011. Global Action Networks: Creating our future together, Palgrave Macmillan/ Bocconi University Press, New York/London, 244 p.

Warner K.D., 2008. Agroecology as participatory science: Emerging alternatives to technology transfer extension practice. Science, Technology, & Human Values, 33, 754-777.

Weick K.E., 2001. Making Sense of the Organization, Blackwell Publishers, Oxford, United Kingdom, 483 p.

Weltin M., Zasada I., Piorr A., Debolini M., Geniaux G., Moreno Perez O., Scherer L., Tudela Marco L., Schulp C.J.E., 2018. Conceptualising fields of action for sustainable intensification: A systematic literature review and application to regional case studies. Agriculture, Ecosystems and Environment, 257, 68-80.

Whiteside M., 1998. Living Farms: Encouraging sustainable smallholders in Southern Africa, Earthscan Publications, London, 217 p.